REMARKS

The Office Action dated March 15, 2007 has been carefully reviewed and the forgoing amendment and following remarks have been made in consequence thereof.

Applicant believes that no extension of term is required and that no additional fee for claims is required. If any additional fee is required for an extension of term or claims, the Commissioner is hereby authorized to charge Deposit Account No. 01-2384.

Claims 1-3, 6, 7, 9-13, 16, 17, 19-24, 26, and 28, and 29 are pending in this application. Claims 9, 19, 21-24, 26, and 28 are withdrawn. Claims 1-3, 6, 7, 10-13, 16, 17, and 20 stand rejected.

Applicants note that although still pending in this application, Claim 29 was not addressed in the Office Action dated March 15, 2007. This response assumes that Claim 29 is rejected similarly to the other pending Claims in this application. Further clarification on the status of Claim 29 is requested.

Applicants and the undersigned wish to thank Examiner Karlsen for the courtesies he extended in a telephonic interview with William Zychlewicz on March 20, 2007, in which the § 112 rejections were discussed. More specifically, particular regard was made to the shape of a magnetic field and how a Hall effect device is configured to sense the shape of a magnetic field. It was agreed that a response to the Office Action dated March 15, 2007 would be the most appropriate response to the outstanding Office Action. No further agreement was reached.

The rejection of Claims 1-3, 6, 7, 10-13, 16, 17, and 20 under 35 U.S.C. § 112, first paragraph, is respectfully traversed.

The Office Action asserts at page 4 that "It is not clear how plural Hall devices would be placed in the slot of the conductor 16 of Figure 2 to produce the desired result." The original specification recites:

> Slot 32 is designed such that a current introduced at first edge 22 is divided into two approximately equal current components. Current sensor 10 is inserted at least partially into slot 32 and

> facilitates detecting a magnetic field created by current carrying conductor 16. The current components then generate two magnetic field components that are shaped such that they are substantially in the opposite direction and substantially equal in magnitude.
>
> In use, a chip or a circuit board containing a pair of Hall effect devices 12 is disposed in slot 32 where a magnetic field B has the desired spatial behavior. A current is introduced into conductor 16 thereby generating a magnetic field having a pre-determined shape around conductor 16. In one embodiment, the magnetic field is shaped by slot 32 such that a pre-determined spatial dependence is introduced into the magnetic field.

Specification, page 3 lines 9-20. The original specification describes that conductor 16 and the shape of slot 32 defines the shape of the magnetic field generated by conductor 16. As is known, the strength of a magnetic field varies inversely with distance. The magnetic field has a shape based on the current flowing through conductor 16, the shape of conductor 16, the shape of slot 32, and a spatial dependence of the magnetic field is based on a distance and direction from conductor 16. As described in the original specification above, a pair of Hall effect devices 12 is disposed in slot 32 where the magnetic field has the desired spatial behavior. The original specification further describes that:

> Hall effect devices 12 are placed a pre-determined distance from each other such a Hall effect device 12 can detect least a first magnetic field component having a first direction and another Hall effect device can detect a second magnetic field component having a second direction different from the first direction. The magnetic field B components are created in such a way that they substantially change direction over a relatively short distance.

Specification, page 4 lines 9-15.

Claim 1 recites "a conductor comprising an aperture therethrough and a plurality of Hall effect devices inserted at least partially within said aperture and aligned substantially perpendicularly to a longitudinal axis of the conductor and in the same plane as the conductor portions on either side of the aperture...said conductor is configured to generate a magnetic field having a pre-determined shape, each said Hall effect device configured to generate an output based on said pre-determined shape." Independent Claims 10, 11, 20, and 29 include similar

recitations. As explained above, Applicants submit that the originally filed specification clearly describes how plural Hall devices would be placed in the slot of the conductor 16 of Figure 2 to produce generate an output based on said pre-determined shape.

The Office Action also asserts that:

> The Examiner is not aware that a Hall effect device can detect a predetermined shape of a magnetic field. It is also not clear what is meant by saying the magnetic fields have shapes. A disk of zero thickness would have a particular two dimensional shape. A ball has a shape in three dimensions. It is not clear how a magnetic field would have a shape.

Office Action dated March 15, 2007 page 4, lines 5-9. Applicants respectfully submit that it is well known in the art that magnetic fields have three dimensional shapes that are routinely described using equations and can easily be visualized using a magnet, a sheet of paper, and some iron filings. For example, Figures 2 and 3 of the prior art reference cited in the § 102(e) rejections in the present Office Action illustrates how the shape of a conductor can affect the shape of the magnetic field surrounding the conductor. Additionally, it is known that the strength of a magnetic field varies inversely with distance and position with respect to the magnetic field source, in the present instance, the right and left legs of conductor 16.

The Office Action further asserts:

> It is not clear from the specification how the Hall devices of Figure 1 are to be positioned in the slot of Figure 2, or indeed, if they are to be positioned in the slot of Figure 2. The specification states in paragraph 0011 that the current in conductor 16 is divided into two equal components. It would appear that such would result in equal and opposite fields in slot 32 which would cancel resulting in a zero field. How the sensor of Figure 1 could detect a zero field is unclear.

Office Action dated March 15, 2007 page 4, lines 12-17. One such way the Hall effect devices 12 may be positioned in slot 32 such that the Hall effect device 12 are configured to generate an output based on the pre-determined shape of the magnetic field generated by conductor 16 is by aligning the Hall effect devices 12 in the plane of conductor 16 perpendicularly to a longitudinal axis of slot 32. Hall effect devices 12 would each indicate an output due to each sensor 12

receiving a larger component of the magnetic field from one of the legs than the magnetic field component from the other leg. The output of each Hall effect current sensor 12 output is determined relative to a shape of conductor 16, a shape of the magnetic field generated by current components 34 and 36 and a distance from and a position relative to conductor 16. Such spatial dependence between each Hall effect current sensor 12 and each leg of conductor 16 permits determining the shape of the magnetic field generated by conductor 16.

The Office Action also asserts that "[i]t is unclear how the circuitry of Figure 4 is structured," and "[s]ome elements are not connected to anything." Applicants respectfully submit that Figure 4 is a block diagram of a Hall effect based electronic electricity meter and not a schematic diagram or wiring diagram where all wiring connections may be expected to be shown explicitly. The block diagram of Figure 4 and the associated specification portion that describes Figure 4 is submitted to describe an embodiment of an electricity meter such that one skilled in the art of electricity meters to make and/or use the invention.

The Office Action also asserts that "[i]t is not clear what the lower structure of Figure 2 is supposed to represent." Figure 2 has been renumbered to Figure 2A and Figure 2B. The lower structure in Figure 2 referenced in the Office Action is now Figure 2B and is described in the revised portion of the specification detailed above in the amendment to the specification.

Accordingly, Applicants submit that one skilled in the art, after reading the specification, would understand the recitation of a "conductor comprising an aperture therethrough and a plurality of Hall effect devices inserted at least partially within said aperture, said conductor is configured to generate a magnetic field having a pre-determined shape, each said Hall effect device configured to generate an output based on said pre-determined shape" as recited in Claim 1.

The specification has been amended to more clearly describe embodiments of the present invention. No new matter has been added.

For at least these reasons, Applicants respectfully submits that Claims 1, 10, 11, 20, and 29 satisfy Section 112, first paragraph.

Claims 2, 3, 6, 7, 12, 13, 16, and 17 depend, directly or indirectly, from independent Claims 1, 10, 11, 20, and 29. When the recitations of Claims 2, 3, 6, 7, 12, 13, 16, and 17 are considered in combination with the recitations of Claims 1, 10, 11, 20, and 29, Applicants respectfully submit that dependent Claims 2, 3, 6, 7, 12, 13, 16, and 17 likewise satisfy Section 112, first paragraph.

The rejection of Claims 1-3, 6, 7, 10-13, 16, 17, and 20 under 35 U.S.C. § 112, second paragraph, is respectfully traversed, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention is respectfully traversed. The Office Action asserts that "it is not clear what is meant by the conductor being configured to generate a magnetic field having a pre-determined shape, the Hall effect device being configured to detect a magnetic field of predetermined shape or the Hall effect device being configured to be insensitive to magnetic fields having shapes other than the pre-determined shape." As described above, the magnetic field generated by a flow of electrical current is defined by the direction and magnitude of the current flow. The magnetic field surrounds the conductor such that a three dimensional shape of the magnetic field surrounding the conductor is determinable in accordance with embodiments of the present invention. Because the magnetic field is spatially dependent, for example, has different values of direction and magnitude at different points surrounding conductor 16, a shape of the magnetic field may be ascertained by measuring the strength and direction of the magnetic field at a plurality of points surrounding conductor 16. The specification has been amended to more clearly describe embodiments of the present invention. No new matter has been added. Applicants respectfully submit that Claims 1, 10, 11, 20, and 29 are definite and distinctly claim the subject matter of the invention. For at least these reasons, Applicants respectfully request withdrawal of the Section 112, second paragraph, rejection to Claims 1, 10, 11, 20, and 29.

Claims 2, 3, 6, 7, 12, 13, 16, and 17 depend, directly or indirectly, from independent Claims 1, 10, 11, 20, and 29. When the recitations of Claims 2, 3, 6, 7, 12, 13, 16, and 17 are considered in combination with the recitations of Claims 1, 10, 11, 20, and 29, Applicants respectfully submit that dependent Claims 2, 3, 6, 7, 12, 13, 16, and 17 likewise satisfy Section 112, second paragraph.

The rejection of Claims 1-3, 6, 7, 10-13, 16, 17, and 20 under 35 U.S.C. § 102(e) as being anticipated by Ladds (U.S. Patent 6,040,690) is respectfully traversed.

Ladds describes an electricity measurement apparatus includes two spaced-apart parallel conductors through which current flows in the same direction inducing a magnetic field between the conductors. Two magnetic field sensors are disposed on each side of a first plane in which the conductors lie. The sensors are in a second plane that is substantially between the conductors and perpendicular to the first plane. An arithmetic processor processes signals from the sensors to provide a value representative of current flow. The provided value is substantially independent of the position of the second plane within the space between the conductors.

Claim 1 recites a current sensor for an apparatus wherein the current sensor includes "a conductor comprising an aperture therethrough and a plurality of Hall effect devices inserted at least partially within said aperture and aligned substantially perpendicularly to a longitudinal axis of the conductor and in the same plane as the conductor portions on either side of the aperture...said conductor is configured to generate a magnetic field having a pre-determined shape...each said Hall effect device configured to generate an output based on said pre-determined shape...each said Hall effect device configured to be insensitive to magnetic fields having shapes other than the pre-determined shape."

Ladds does not describe nor suggest a current sensor as recited in Claim 1. Specifically, Ladds does not describe nor suggest a current sensor including a conductor including an aperture therethrough and a plurality of Hall effect devices inserted at least partially within the aperture and aligned substantially perpendicularly to a longitudinal axis of the conductor and in the same plane as the conductor portions on either side of the aperture. Moreover, Ladds does not describe or suggest a conductor configured to generate a magnetic field having a pre-determined shape and that each Hall effect device is configured to generate an output based on the pre-determined shape. Further, Ladds does not describe or suggest that the Hall effect device is configured to be insensitive to magnetic fields having shapes other than the pre-determined shape. Rather, Ladds describes two magnetic field sensors disposed on each side of a first plane in which the conductors lie wherein the sensors are in a second plane that is substantially between the conductors and perpendicular to the first plane. Accordingly, Ladds does not

describe nor suggest a plurality of Hall effect devices inserted at least partially within the aperture and aligned substantially perpendicularly to a longitudinal axis of the conductor and in the same plane as the conductor portions on either side of the aperture. For the reasons set forth above, Claim 1 is submitted to be patentable over Ladds

Claims 2, 3, 6, and 7 depend from independent Claim 1. When the recitations of Claims 2, 3, 6, and 7 are considered in combination with the recitations of Claim 1, Applicants submit that dependent Claims 2, 3, 6, and 7 likewise are patentable over Ladds

Claim 10 recites a "current sensor for an apparatus comprising a conductor comprising an aperture therethrough and a plurality of Hall effect devices inserted at least partially within said aperture and aligned substantially perpendicularly to a longitudinal axis of the conductor and in the same plane as the conductor portions on either side of the aperture, said conductor is configured to generate a magnetic field comprising at least a first magnetic field component having a first direction and a second magnetic field component having a second direction different from said first direction, and a pre-determined shape, each said Hall effect device configured to detect said pre-determined shape and generate an output, and each said Hall effect device configured to be insensitive to magnetic fields having spatial dependencies other than a spatial dependence defined by the pre-determined shape."

Ladds does not describe nor suggest a current sensor as recited in Claim 10. Specifically, Ladds does not describe nor suggest a current sensor including a conductor including an aperture therethrough and a plurality of Hall effect devices inserted at least partially within the aperture and aligned substantially perpendicularly to a longitudinal axis of the conductor and in the same plane as the conductor portions on either side of the aperture. Moreover, Ladds does not describe or suggest a conductor configured to generate a magnetic field comprising at least a first magnetic field component having a first direction and a second magnetic field component having a second direction different from said first direction, and a pre-determined shape. Rather, Ladds describes two magnetic field sensors disposed on each side of a first plane in which the conductors lie wherein the sensors are in a second plane that is substantially between the conductors and perpendicular to the first plane. Accordingly, Ladds does not describe nor suggest a plurality of Hall effect devices inserted at least partially within the aperture and aligned

substantially perpendicularly to a longitudinal axis of the conductor and in the same plane as the conductor portions on either side of the aperture. For the reasons set forth above, Claim 10 is submitted to be patentable over Ladds.

Claim 11 recites a "residential electricity meter comprising a voltage sensor and a current sensor, said current sensor comprising a conductor comprising an aperture therethrough and a plurality of Hall effect devices inserted at least partially within said aperture and aligned substantially perpendicularly to a longitudinal axis of the conductor and in the same plane as the conductor portions on either side of the aperture, said conductor is configured to generate a magnetic field having a pre-determined shape, each said Hall effect device configured to detect said pre-determined shape and generate an output, and each said Hall effect device configured to be insensitive to magnetic fields having shapes other than the pre-determined shape."

Ladds does not describe nor suggest a residential electricity meter as recited in Claim 11. Specifically, Ladds does not describe nor suggest a current sensor including a conductor including an aperture therethrough and a plurality of Hall effect devices inserted at least partially within the aperture and aligned substantially perpendicularly to a longitudinal axis of the conductor and in the same plane as the conductor portions on either side of the aperture. Rather, Ladds describes two magnetic field sensors disposed on each side of a first plane in which the conductors lie wherein the sensors are in a second plane that is substantially between the conductors and perpendicular to the first plane. Accordingly, Ladds does not describe nor suggest a plurality of Hall effect devices inserted at least partially within the aperture and aligned substantially perpendicularly to a longitudinal axis of the conductor and in the same plane as the conductor portions on either side of the aperture. For the reasons set forth above, Claim 11 is submitted to be patentable over Ladds.

Claims 12, 13, 16, and 17 depend from independent Claim 11. When the recitations of Claims 12, 13, 16, and 17 are considered in combination with the recitations of Claim 11, Applicants submit that dependent Claims 12, 13, 16, and 17 likewise are patentable over Ladds

Claim 20 recites a "residential electricity meter comprising a voltage sensor and a current sensor, said current sensor comprising a conductor comprising an aperture therethrough and a

plurality of Hall effect devices inserted at least partially within said aperture and aligned substantially perpendicularly to a longitudinal axis of the conductor and in the same plane as the conductor portions on either side of the aperture, said conductor is configured to generate a magnetic field comprising at least a first magnetic field component having a first direction and a second magnetic field component having a second direction different from said first direction, and a pre-determined shape, each said Hall effect device configured to detect said pre-determined shape and generate an output, and each said Hall effect device configured to be insensitive to magnetic fields having spatial dependencies other than a spatial dependence defined by the pre-determined shape."

Ladds does not describe nor suggest a residential electricity meter as recited in Claim 20. Specifically, Ladds does not describe nor suggest a current sensor including a conductor including an aperture therethrough and a plurality of Hall effect devices inserted at least partially within the aperture and aligned substantially perpendicularly to a longitudinal axis of the conductor and in the same plane as the conductor portions on either side of the aperture. Rather, Ladds describes two magnetic field sensors disposed on each side of a first plane in which the conductors lie wherein the sensors are in a second plane that is substantially between the conductors and perpendicular to the first plane. Accordingly, Ladds does not describe nor suggest a plurality of Hall effect devices inserted at least partially within the aperture and aligned substantially perpendicularly to a longitudinal axis of the conductor and in the same plane as the conductor portions on either side of the aperture. For the reasons set forth above, Claim 20 is submitted to be patentable over Ladds.

Claim 29 recites a "residential electricity meter comprising a voltage sensor and a current sensor, said current sensor comprising a conductor comprising an aperture therethrough and a plurality of Hall effect devices inserted at least partially within said aperture and aligned substantially perpendicularly to a longitudinal axis of the conductor and in the same plane as the conductor portions on either side of the aperture, said conductor is configured to generate a magnetic field comprising at least a first magnetic field component having a first direction and a second magnetic field component having a second direction different from said first direction, and a pre-determined shape, each said Hall effect device configured to detect said pre-determined shape and generate an output, and each said Hall effect device configured to be

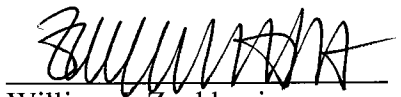
insensitive to magnetic fields having spatial dependencies other than a spatial dependence defined by the pre-determined shape."

Ladds does not describe nor suggest a residential electricity meter as recited in Claim 29. Specifically, Ladds does not describe nor suggest a current sensor including a conductor including an aperture therethrough and a plurality of Hall effect devices inserted at least partially within the aperture and aligned substantially perpendicularly to a longitudinal axis of the conductor and in the same plane as the conductor portions on either side of the aperture. Rather, Ladds describes two magnetic field sensors disposed on each side of a first plane in which the conductors lie wherein the sensors are in a second plane that is substantially between the conductors and perpendicular to the first plane. Accordingly, Ladds does not describe nor suggest a plurality of Hall effect devices inserted at least partially within the aperture and aligned substantially perpendicularly to a longitudinal axis of the conductor and in the same plane as the conductor portions on either side of the aperture. For the reasons set forth above, Claim 20 is submitted to be patentable over Ladds.

For at least the reasons set forth above, Applicants respectfully request that the Section 102 rejection of Claims 1-3, 6, 7, 10-13, 16, 17, 20, and 29 be withdrawn.

In view of the foregoing remarks, all the claims now active in this application are believed to be in condition for allowance. Reconsideration and favorable action is respectfully requested.

Respectfully Submitted,



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